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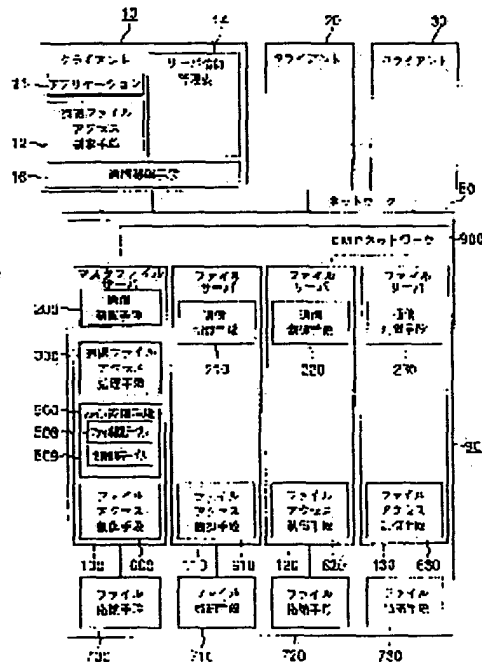
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(54) FILE SERVER SYSTEM AND FILE ACCESS CONTROLLING METHOD THEREFOR

(57)Abstract:

PURPOSE: To prevent the throughput due to the centralization of access requests in a specified file server from plural clients, in a file server system where plural file servers accessing each file storage devices are arranged side by side via a network.

CONSTITUTION: The master file server 100 of file servers 100, 110, 120 and 130 composing a file server system 90 is provided with a file control means controlling files by using a load information table 508 measuring/controlling the load status of each file server and a file attribute table recording/controlling a file server in charge of the access every file block, selecting a file server where load is light at the time of writing a file, in particular and distributing the file access requests transmitted from client computers 10, 20 and 30 to the selected file server.



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CLAIMS

[Claim(s)]

[Claim 1] In the file server system which shares the file which has two or more file servers *** (ed) on the network, and was distributed by the above-mentioned file server among two or more client computers A file storing means to store a file in each of two or more above-mentioned file servers. The first communications control means which performs communications control with other file servers through the above-mentioned network. A file access control means to receive a file access demand and to perform a file access to the above-mentioned file storing means is established. The second communications control means which performs communications control with the above-mentioned client computer to a specific file server among two or more above-mentioned file servers. A remote file-access-operation means to manage the communications protocol of the file access demand published from the above-mentioned client computer. A load information monitoring means to measure each load situation of two or more above-mentioned file servers. The file server which performs a file access from two or more above-mentioned file servers with reference to the load situation measured by the above-mentioned load information monitoring means is selected. When the selected file server is a self file server, a file access demand is published to the file access control means of a self file server. When the selected file servers are other file servers, the communications control means of the above 1st is minded. The file server system characterized by establishing further a file access demand distribution means to publish the file access demand which publishes a file access demand to the file access control means of the selected file server.

[Claim 2] The above-mentioned load information monitoring means is a file server system

including the means which carries out counting of the unsettled number of file access demands in each of two or more above-mentioned file servers according to claim 1.

[Claim 3] The file server system according to claim 1 characterized by providing the following.

The above-mentioned file access demand distribution means is a write-in read-out judging means for the file access demand published from the above-mentioned client computer to read in a write request, and to judge a demand. A file division arrangement means to select the file server which stores a file with reference to the load situation measured by the aforementioned load information monitoring means at the time of file writing. A file server scheduling means for access to select the file server made into the object of read-out from the file server in which it reads with reference to the load situation measured by the above-mentioned load information monitoring means at the time of file read-out, and the object file is stored.

[Claim 4] The above-mentioned file division arrangement means is a file server system according to claim 3 characterized by establishing a file division arrangement means to select at least two or more file servers which store the file for writing.

[Claim 5] It is the file-server system according to claim 3 characterized by for the above-mentioned file division arrangement means to select at least two or more file servers which store the file for writing, and for the above-mentioned file-server scheduling means for access to read a file server with a light load with reference to the load situation acquired by the aforementioned load information monitoring means among the file servers in which the file for read-out is stored, and to select as a target file server.

[Claim 6] It is the file server system according to claim 3 which the above-mentioned file division arrangement means generates the file attribute table showing the correspondence relation between this file and this file server in case the file server which stores a file is selected, and is carried out as the feature here where the file server in which the above-mentioned server scheduling means for access is read with reference to the above-mentioned file attribute table, and the target file is stored is specified.

[Claim 7] The file server system according to claim 1 characterized by preparing the communications control means of the above second, and the above-mentioned remote file-access-operation means or more in at least two of two or more above-mentioned file servers, respectively.

[Claim 8] The file server system according to claim 1 characterized by preparing the above-mentioned load information monitoring means and the above-mentioned file access demand distribution means or more in at least two of two or more above-mentioned file servers, respectively.

[Claim 9] The file server system according to claim 7 characterized by preparing the above-mentioned load information monitoring means and the above-mentioned file access demand distribution means or more in at least two of two or more above-mentioned file servers, respectively.

[Claim 10] It is the file server system according to claim 1 which the above-mentioned client computer is connected to the above-mentioned network, and is characterized by ** to which the communications control means of the above first achieves the function of the communications control of the above-mentioned client computer and the above-mentioned specific file server instead of the communications control means of the above second.

[Claim 11] It is the file server system according to claim 1 characterized by connecting the above-mentioned client computer to the 1st network, connecting two or more above-mentioned file servers to the 2nd network, and connecting the above 1st and the 2nd network with a bridge means to distribute the file access demand from the above-mentioned client computer to the above-mentioned specific file server.

[Claim 12] The communications control means of the above first is a file server system according to claim 1 characterized by performing communication with other file servers through a system bus.

[Claim 13] The above-mentioned system bus is a file server system according to claim 12 characterized by being the dedicated bus used only for communication between two or more above-mentioned file servers.

[Claim 14] In the file access control method in the file server system which shares the file which has two or more file servers *** (ed) on the network, and was distributed by two or more file servers of the above-mentioned file among two or more client computers. The file access demand which measured each load information on two or more above-mentioned file servers, and was published through the above-mentioned network from the client computer in the *** case with a receptacle. The file access control method containing the step of selecting the file server which performs a file access with reference to the above-mentioned load information, and distributing a file access demand to the above-mentioned selection file server.

[Claim 15] The step which measures the above-mentioned load information is the file access control method containing the step which carries out counting of each unsettled number of file access demands of two or more above-mentioned file servers according to claim 14.

[Claim 16] The step which selects the file server which performs the above-mentioned file access. The file access demand published from the client computer reads in a write request, and judges a demand. At the time of file writing, the file server for file storing is selected with reference to the measured load situation. The file access control method according to claim 14 characterized by including the step of reading from the file server in which it reads with reference to the measured load situation at the time of file read-out, and the object file is stored, and selecting the target file server.

[Claim 17] The file access control method characterized by selecting at least two or more file servers which write in the file access control method according to claim 16 at the step which

selects the file server for [above] file storing, and store an object file.

[Claim 18] The file access control method characterized by choosing and reading a file server with a light load based on the load information measured among two or more file servers in which it reads in the file access control method according to claim 16 at the step which selects the file server for [above] read-out, and the object file is stored, and considering as the target file server.

[Claim 19] In the file access control method according to claim 16, in case the file server which stores a file is selected, the file attribute table showing the correspondence relation between this file and this file server is generated, and the above-mentioned server scheduling means for access specifies the file server in which it reads with reference to the above-mentioned file attribute table, and the target file is stored. [Claim 20] In the file access control method according to claim 14, the step which selects the above-mentioned file server for a file access

The load information on each file server is measured by at least two or more file servers. The file access demand published from the client computer is received by the file server which measures the above-mentioned load information. The high-speed file access control method characterized by distributing a file access demand to the file server which selected the file server for a file access with reference to the above-mentioned load information, and was selected as a file server for a file access.

[Claim 21] The file access control method characterized by writing in a file server with few loads, selecting as an object file server when a file access is file writing, reading a file server with few loads from the file server in which the file is stored when a file access is file read-out in the file access control method according to claim 20 at the step which selects the above-mentioned file server for a file access, and selecting as an object file server.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention is concerned with computing systems, such as a workstation and a server, and relates to the file server system especially in the computing system of multiprocessor composition which accesses the file stored in the secondary storage at high speed, and its file access control method.

[0002]

[Description of the Prior Art] In recent years, the network of a computer has been progressing. In connection with this, the need of the file server which manages collectively the file shared between computers is increasing. This is because a file system can be built by the low cost. That is, it is because two or more same files are copied and it is necessary to cease to possess them among two or more computers, since it becomes sharable [a file] among two or more computers by using a file server. It becomes possible to access as if it was the file stored in the client computer itself by usually carrying the network correspondence file system in the file server, and carrying a network correspondence file system access program also in the computer of a client side connected to the same network. Therefore, it becomes possible to access to the file which is accumulated on a file server from every client computer connected to the network, and is managed, and sharing of the file between two or more client computers is realized.

[0003] Managing NFS and NIS (Hal Stern, O'Reilly & Associates, Inc, June 1991, p.113 to p.159) has the description about a network correspondence file system.

[0004] However, when sharing the file in a file server using a network correspondence file system, a performance problem may arise. That is, in performing a file access simultaneously from many client computers, a load concentrates on a file server and the situation that an access result is not obtained immediately occurs.

[0005] Therefore, when the load to a file server becomes excessive and the access throughput of a client computer falls, ***(ing) two or more sets of file servers on a network, and distributing the access demand from two or more client computer is performed. Each client computer manages the information on all the file servers currently installed on the network, and publishes an access demand to the file server in which the file for access exists with reference to this management information. When the file for access of each client computer is stored in the separate file server by this, it becomes possible to distribute a load and it can improve an access throughput.

[0006] Although it is not client - and - server composition, one main processor manages two or more whole data files, and the above-mentioned system and a similar system are indicated by Japanese public presentation JP.04.B -48352 [No. (1992)] in respect of if these data files are distributed by two or more sub processors.

[0007]

[Problem(s) to be Solved by the Invention] Though two or more sets of file servers are installed and a file is shared among many client computers as mentioned above, the following problems remain.

[0008] Two or more client computers may give an access demand to one file server

simultaneously, an applicable file server serves as a bottleneck in that case, and the problem that a throughput will fall produces a client computer in order to access the file server in which a file exists completely regardless of the load situation of a file server. The degradation will become excessive if two or more directories where a client computer is the same and same files are accessed especially simultaneously. Even if this problem increases the installation number of the character top file server, it is not solvable.

[0009] The purpose of this invention is offering the file server system which can prevent generating of the bottleneck by concentration of access to a specific file server, and the fall of the throughput accompanying it, and its file access control method, even when two or more client computers access the same directory and the same file simultaneously in the network which ***(ed) two or more file servers, in order to share the file between many client computers.

[0010]

[Means for Solving the Problem] One feature of the file access control method of this invention in the file server system which shares the file which has two or more file servers ***(ed) on the network, and was distributed by two or more file servers among two or more client computers. The file access demand which measured each load information on two or more above-mentioned file servers, and was published through the above-mentioned network from the client computer in the *** case with a receptacle. The file server which performs a file access with reference to the above-mentioned load information is selected, and it is in the file access control method containing the step of distributing a file access demand to the above-mentioned selection file server.

[0011] When the file access demand from a client computer being a write request of a new file, speaking more concretely, the load information on two or more file servers is measured, the lightest file server of a load is selected, and a file write request is published to the file server. Or in producing the file of mirror composition, two or more file servers with a light load are selected, and it publishes a file write request to each of those file servers. Moreover, the file access demand from a client computer is a file read-out demand, when the file for read-out is carried out to mirror composition, the load information on two or more file servers which take charge of two or more multiple-files enclosure of each in which the file for read-out was stored is measured, one lightest file server of a load is selected, and a file read-out demand is published to the file server.

[0012] Measurement of the above-mentioned load information is performed by carrying out counting of each unsettled number of file access demands of two or more above-mentioned file servers. For this reason, at least one of two or more file servers is made into a master file server, and the load information monitoring means which records and updates each unsettled number of file access demands of two or more file servers at a load information table is prepared in this master file server. Moreover, a means to distribute the file access demand from a client computer using the file attribute table which records the correspondence relation of the file information table is prepared in this master file server.

[0013] The typical composition of the file server system according to this invention in the file server system which shares the file which has two or more file servers ***(ed) on the network, and was distributed by the above-mentioned file server among two or more client computers. A file storing means to store a file in each of two or more above-mentioned file servers. The first communications control means which performs communications control with other file servers through the above-mentioned network. A file access control means to receive a file access demand and to perform a file access to the above-mentioned file storing means is established. On the other hand, to a specific file server among two or more above-mentioned file servers at these In addition, the second communications control means which performs communications control with the above-mentioned client computer. A remote file-access-operation means to manage the communications protocol of the file access demand published from the above-mentioned client computer. A load information monitoring means to measure each load situation of two or more above-mentioned file servers. The file server which performs a file access from

two or more above-mentioned file servers with reference to the load situation measured by the above-mentioned load information monitoring means is selected. When the selected file server is a self file server, a file access demand is published to the file access control means of a self file server. It is the composition of having established further a file access demand distribution means to publish a file access demand to the file access control means of the selected file server through the communications control means of the above 1st when the selected file servers were other file servers.

[0014]

[Function] According to such a method and a system configuration, it can access to a file server with few file access loads. And since a file and its duplicate file are stored in two or more file servers, the access demand from a client computer to the same directory and the same file can also be distributed according to the load situation to two or more file servers. That is, even when ***(ing) two or more file servers, sharing a file among many client computers on a network and two or more directories and files with the same client computer are accessed simultaneously, generating of the bottleneck by concentration of access to a specific file server and the fall of the throughput accompanying it can be prevented, and access of the high throughput from a client computer can be realized.

[0015]

[Example] The composition of the example of this invention is explained with reference to drawing 1.

[0016] The file server system 90 constituted from a loose-coupling multiprocessor and the client computers 10, 20, and 30 are connected by Local Area Network 50. In each of the client computers 10, 20, and 30, if an application program 11 is performed and a file access demand occurs by this, a file access demand will be published from the remote file access demand generating means 12 in the file server system 90. Specifically, a file access demand is transmitted to the file server 100 which is specific one of four sets of the file servers 100, 110, 120, and 130 which constitute the file server system 90 through Local Area Network 50 from the communications control means 16. As for four sets of file servers 100, 110, 120, and 130, each takes charge of individually access of the file storing meanses 700, 710, 720, and 730. Therefore, the file access control meanses 600, 610, 620, and 630 are formed in file servers 100, 110, 120, and 130, respectively. Moreover, file servers 100, 110, 120, and 130 communicate mutually through the LCMP network 900. For this reason, the communications control meanses 200, 210, 220, and 230 are formed in each file server.

[0017] In this example, the above-mentioned specific file server 100 is called master file server. The remote file-access-operation means 300 for the master file server 100 receiving the file access demand further published from the client computer and a file management means 500 to distribute the file access demand which managed and received distribution of a file so that the load of each file server might not incline greatly to each file server are formed. For distribution of this file management and a file access demand, the file attribute load information table 508 and 509 is used. The information on the master file server 100, i.e., the machine address of the master file server 100, is stored in the server information management table 14 of a client computer.

[0018] Drawing 2 is the block diagram showing the equipment configuration of the master file server 100. The master file server 100 includes the processor 101 mutually connected by the system bus 107, main memory 102, the network interface circuit 103, and the LCMP network interface circuit 104. The remote file-access-operation program 301, file management 501, the file access control program 601, and a communication control program 201 are loaded to main memory 102 from the secondary storage which is not illustrated at the time of system starting, respectively, and the remote file-access-operation means 300 which this showed to drawing 1, the file management means 500, the file access control means 600, and the communications control means 200 are formed. A file storing means 700 for the master file server 100 to write in and to take charge of read-out is a magnetic disk unit as shown in drawing 2, and it is connected to a system bus 107. In addition, the file storing meanses 700 may be optical-magnetic disc equipment, an optical disk unit, and other secondary storages.

[0019] File servers 110, 120, and 130 other than master file server 100 of drawing 1 also have the composition almost same with being shown in drawing 2, respectively. However, a remote file access program and file management are not loaded to such main memory. Moreover, a network interface circuit 103 for connection to Local Area Network 50 is also unnecessary.

[0020] Drawing 3 shows the program composition of the master file server 100. The network access program 205 which a communication control program 201 turns into to the interface of Local Area Network 50 and the master file server 100. The interprocessor communication drive-access program 206 used as the interface of the LCMP network 900 and the master file server 100. The network communication protocol control program 207 which carries out protocol conversion and which is passed so that the remote file-access-operation program 301 can interpret the demand received from the network access program 205. It consists of interprocessor communication protocol control programs 208 which carry out protocol conversion of the access demand to other file servers interpreted by the file access control program 601 explained later, and are passed to the interprocessor communication drive-access program 206. The file access control program 601 receives the information about file enclosure and a file server from file management 501. When the self processor 101 accesses the file enclosure 700 which takes charge of an access control, the information about file enclosure is passed to the file enclosure access program 604. When other file servers 110-130 access the file enclosure 710-730 which takes charge of an access control, the information about file enclosure is passed to the interprocessor communication protocol control program 208. The file enclosure discernment program 603 which requests access from other file servers. The information about file enclosure is received from the file enclosure discernment program 603, and it consists of file enclosure access programs 604 which access the magnetic disk unit 700 which stores the target file.

[0021] File management 501 is explained also with reference to drawing 4 which shows still more detailed program composition. File management 501 changes into the information on a file server, the information on file enclosure, and the information on the file storing position in file enclosure the file access demand which managed the file attribute table 508 and the load information table 509, and was passed from the remote file-access-operation program 301 using these, and passes it to the file access control program 601. File server selection for [according to distribution and it of a file] access is processed. Therefore, the file management 501 The file access demand receptionist program 504 which the file access demand passed from the remote file-access-operation program 301 is received, and it reads in a write request, and distinguishes a demand. The file distribution program 502 which determines by which file server a file is written in at the time of file writing. The read-out demand scheduling program 503 which determines which file server is accessed at the time of read-out. It consists of load information monitoring programs 505 which measure the load situation of each file server by carrying out counting of the number of unsettled access demands of each file server. The information on the file storing position in the file server identifier corresponding to each file by which the file is stored in the file attribute table 508, a file enclosure identifier, and file enclosure is held. The number of unsettled access demands of each file server is held at the load information table 509.

[0022] Next, the 1st example of a file attribute table is shown in drawing 5. This example is an example in the case of performing distribution in a file unit, without having a duplicate, without dividing one file. A file attribute table consists of two fields, (1) file-attribute field and (2) disk-block index area. A file attribute field consists of each entry of a file size, file storing mode, a file access processor identifier, and a file storing device identifier. It is shown whether the file is stored in the file enclosure in which the file's being stored in the file enclosure to which the self file server which has managed a local those with remote **, and the file attribute table takes charge of an access control in file storing mode, or other file servers take charge of an access control. A file access processor identifier shows the identifier of the file server which takes charge of the access control of file enclosure with which the file corresponding to a file attribute table is stored. A file storing device identifier shows the file enclosure in which the file is stored. The disk block index area consists of indexes which show the position within the file enclosure of each of a series of disk block which constitutes a file.

[0023] Next, the 2nd example of a file attribute table is shown in drawing 6. This example is an example in the case of distributing by dividing one file. A file attribute table consists of two fields, (1) file-attribute field and (2) disk-block index area, like the 1st example of drawing 5. However, the file attribute field existed for every disk block, and the storing place is specified. The example shown in drawing 6 shows that the 1st data block which constitutes a file exists in the position of the index of No. 100 of the disk unit of No. 1 where the 1st file server performs an access control. It is shown that the 3rd data block exists in the position of the index of No. 200 of the disk unit of No. 1 where, as for the 2nd data block, the 2nd file server performs an access control hereafter in the position of the index of No. 300 of the disk unit of No. 1 where the 3rd file server performs an access control.

[0024] On the other hand, the program composition of a file server 110 is as being shown in drawing 7. A communication control program 211 consists of an interprocessor communication drive-access program 212 which becomes the interface of transmission through the LCMP network 900, i.e., an interface with the master file server 100, and an interprocessor communication protocol control program 213 which carries out protocol conversion and which is passed so that the file access control program 611 can interpret the access demand received from the interprocessor communication drive-access program 206. A file access control program 208, and consists of file enclosure access programs 612 which access the magnetic disk unit 710 which stores the target file. The program composition of file servers 120 and 130 is completely the same as that of drawing 7.

[0025] Next, operation of this example is explained using drawing 8.

[0026] If the processing demand which includes a file access demand or a file access by execution of an application program 11 occurs in either of the client computers 10, 20, and 30, the remote file access demand program 13 will be started, and a processing demand will be transmitted to the master file server 100 through Local Area Network 50. Communication through Local Area Network 50 is performed to a client computer and the master file server 100 using the communication control programs 17 and 201 carried, respectively. If a file access demand is sent to a file server 100, the remote file-access-operation program 301 of a file server 100 will be started. In the remote file-access-operation program 301, the received content is analyzed, the file access demand from a client computer is extracted, and a file-access-operation demand is sent to file management 501.

[0027] File management 501 operates, as shown in drawing 9, first, if judge whether the file access demand is writing and whether it is read-out, write in, come out, and it is, and the file distribution program 502 is started and read, comes out and it is after receiving the file access demand from the remote file-access-operation program 301 in the file access demand receptionist program 504, it will read and the demand scheduling program 503 will be started. In the file distribution program 502, the file attribute table to a write-in file is created, and, next, a file server with few access demand unsettled numbers is determined with reference to the load information table 509 as a file server which stores a file. Moreover, in creating the duplicate of a file and storing in other file servers, with reference to the load information table 509, it determines a file server with few access demand unsettled numbers again as a file server which stores the duplicate of a file. It records on the file attribute table 508 by making into a server identifier the information on the file server which stores these files and a duplicate file, and the load information monitoring program 505 is started. In the read-out demand scheduling program 503, the file attribute table 508 to the file to read is gained, and the file server in which the applicable file is stored is deduced from there. When the file is stored not only in one file server but in the file server of others [duplicate / the], it determines which shall be read between a file main part and a duplicate with reference to the load information table 509, and the load information monitoring program 505 is started. In the load information monitoring program 505, by incrementing the access demand unsettled number to the file server for access, the monitoring of the load information is carried out, the information which shows which portion of the target file is accessed is sent to the file access control program 601, and the file access control program 601 is started.

[0028] The file access control program 601 operates according to the processing flow steps 651, 652, and 653 shown in drawing 8. It first judges whether the file enclosure discernment program 603 is access to the file enclosure 710-730 in which other file servers 110-130 take charge of an access control for whether it is access to the file enclosure 700 in which the information passed from file management 501 is analyzed, and the master file server 100 takes charge of an access control (Step 651). In being the former, the information about the file enclosure 700 is passed to the file enclosure access program 604 of the master file server 100, and it directs a file access. In response, the file enclosure access program 604 starts access to the file enclosure 700 (Step 652). In being the latter, it passes the information about file enclosure to the interprocessor communication protocol control program 208 in a communication control program 201, and the execution file server of a file access is specified, and a transfer of a demand is requested. The interprocessor communication protocol control program 208 is processed so that these information can be transmitted through the LCMP network 900, and it is passed to the interprocessor communication drive-access program 206. The interprocessor communication drive-access program 206 sends out the received file access demand to the LCMP network 900, and transmits it to the target file server. Here, it explains that a file server 110 is the target file server. In the file server 110 which is the destination of a file access demand, the interprocessor communication drive-access program 212 receives this demand, and the interprocessor communication protocol control program 213 is passed. The interprocessor communication protocol control program 213 will pass the information about file enclosure to the file enclosure access-control program 612 within the file access control program 611, if this recognizes that it is the file access demand sent from the master file server 100, i.e., other file servers. The file enclosure access program 612 is accessed to the file of the purpose of file enclosure.

[0029] Next, the method of storing of the file in an example is shown in drawing 10 and drawing 11. When the monitoring of the load of a file server is carried out by the load information monitoring program and it stores a file and its duplicate file in two file servers with the lightest load at the time of file writing, the combination of two file enclosure in which the mirror file of the same content is stored so that it may be shown drawing 10 becomes less fixed. On the other hand, it can always fix, it can have the pair of two file servers which store a file and its duplicate file, and the file data of the pair of file enclosure can also be completely considered as mirror composition like drawing 11. The pair of the file server which judges whether the load of which pair is light among two or more pairs of the file server together put also in this case, and stores each file can be determined. It can replace with these, and it can also constitute so that all file servers may overlap mutually and may store the file data of the same content.

[0030] As mentioned above, according to this example, it becomes possible to read with the file distribution program 502 and to access to a file server with few file access loads by the demand scheduling program 503 by managing the number of the access demand which processing has not finished yet by the load information monitoring program 505, and carrying out the monitoring of the file access load to each file server. And since a file and its duplicate file are stored in two or more file servers, even if the access demand from a client computer to the same directory and the same file occurs simultaneously, it can distribute to two or more file servers. That is, even when ****(ing) two or more file servers, sharing a file among many client computers on a network and two or more directories and files with the same client computer are accessed simultaneously, generating of the bottleneck by concentration of access to a specific file server and the fall of the throughput accompanying it can be prevented, and access of the high throughput from a client computer can be realized.

[0031] In addition, although the case where the number of the file enclosure to which each processor performs file access control in the above-mentioned example was one respectively was shown, even if it is the composition which can connect and carry out the access control of two or more sets of the file enclosure to each file server, it is clear that the effect taken by this example and the same effect are acquired.

[0032] Furthermore, even if each program, such as a file enclosure discernment program shown by this example, file management, and a file access control program, consists of hardware, it is

clear that the effect taken by the above-mentioned this example and the same effect are acquired.

[0033] Another example of this invention is shown in drawing 12 - drawing 17, respectively. The example shown in drawing 12 is the composition of having prepared the remote file-access-operation program which existed only in the master file server 100 in other file servers 110, 120, and 130, respectively. Each file servers 100, 110, 120, and 130 are connected through the LCOMP network 900, respectively, and each-other data communication is performed. Furthermore, each file servers 100, 110, 120, and 130 are connected to Local Area Network 50. Therefore, it becomes possible to receive the processing demand which includes a file access demand or file access demand of a client computer through Local Area Network 50 in all file servers. For example, if the processing demand from a client computer communicates to a file server 110, the remote file-access-operation program 311 will interpret the content of communication, will extract a file access demand, and will start a communication control program 211. A communication control program 211 is carried out through the LCOMP network 900, and transmits a file access demand to the master file server 100. The master file server 100 determines the file server which stores a file by file management 501 like the example of drawing 1, or the file server which performs a readout.

[0034] It is the composition of having replaced the example with the composition in which file management exists in the example of drawing 1 only at the specific file server 100, and having prepared file management in drawing 13 at all file servers. Therefore, there is no distinction of a master and a slave among file servers 100, 110, 120, and 130. Furthermore, the storage region of each file enclosure 700, 710, 720, and 730 is quadrisectioned, respectively. Among [1-1] the divided fields, although 1-2, 1-3, and 1-4 were prepared in the 1st file server 100, they are a field which file management 501 manages. Moreover, although a field 2-1, 2-2, 2-3, and 2-4 were prepared in the 2nd file server 110, file management 511 prepared a field 3-1, 3-2, 3-3, and 3-4 in the 3rd file server 120 and file management 521 prepared a field 4-1, 4-2, 4-3, and 4-4 in the 4th file server 130, file management 531 is the field managed, respectively. That is, each file server has mutually the field which can manage self on the file enclosure in which other file servers take charge of an access control and to perform. The remote file-access-operation program 301 prepared only in the 1st file server 100 has the function to distribute the extracted file write request to the file management of each file server one by one. According to this example, distributed management of the file in a file server system can be carried out by four sets of file servers, and it becomes possible to perform file management to 4 sets to simultaneous parallel within one set of a file server system. therefore -- at the same time it acquires the effect of the rapid access of this invention -- a twist -- much more load distribution becomes possible and the effect that the degree of parallel of processing is raised and a file server system throughput can be improved is also acquired

[0035] The example shown in drawing 14 is the composition of having prepared the remote file-access-operation program which existed in the chisel at the 1st file server 100 in all file servers, in the example shown in drawing 13. The effect of becoming possible to receive the processing demand including the file access demand or file access demand which minded LAN in all file servers is acquired at the same time the effect that a throughput can be improved by improvement in the load distribution by distributed management of a file and parallelism is acquired according to this example.

[0036] The example shown in drawing 15 is the file server system of the false loose-coupling multiprocessor composition which substitutes Local Area Network 50 for communication between file servers, without preparing a LCOMP network between each file server. The internal configuration of each file servers 100, 110, 120, and 130 is the same as that of the example's shown in drawing 14. Also in the file server system of this example, it is clear that the effect acquired in each deformation example of the 1st example described above and the same effect are acquired.

[0037] The example shown in drawing 16 is an example which takes the composition connected to Local Area Network 50 through the bridge equipment 60 in which the false file server system of loose-coupling multiprocessor composition has the function which delivers a file access

demand to each file server, and realized the same function as an example to drawing 15's. Communication between each file servers 100, 110, 120, and 130 is performed using the network inside bridge equipment 60, and, in communication with an alien-machine system, is performed through bridge equipment. The monitoring of the load situation of each file server is carried out with bridge equipment 60, and if bridge equipment receives the file access demand from a client computer, it will select the file server which transmits a file access demand based on a load situation. Also in the file server system of this example, the effect acquired in the example's of drawing 14 described previously and the same effect are acquired.

[0038] The examples shown in drawing 17 are the example shown in drawing 14, and an example which realized the same function in the file server system of close coupling multiprocessor composition. The file server system of this example performs communication between file servers through this using a system bus 80 as an interprocessor communication means. The network communication means connected to the system bus 80 performs communication with a client computer. Also in the file server system of this example, the effect acquired in each example described previously and the same effect are acquired.

[Effect of the Invention] According to this invention, it can access to a file server with few file access loads. And since a file and its duplicate file are stored in two or more file servers, the access demand from a client computer to the same directory and the same file can also be distributed according to the load situation to two or more file servers. Therefore, by the system which *** two or more file servers and shares a file among many client computers on a network, even when two or more directories and files with the same client computer are accessed simultaneously, generating of the bottleneck by concentration of access to a specific file server and the fall of the throughput accompanying it can be prevented, and access of the high throughput from a client computer can be realized.

[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

- [Drawing 1] It is the block diagram showing the whole example composition of this invention.
[Drawing 2] It is the block diagram showing the detailed composition of the principal part of an example.
[Drawing 3] It is the block diagram showing the program composition of the master file server of an example.
[Drawing 4] It is the block diagram showing the composition of the file management of an example.
[Drawing 5] It is the conceptual diagram showing an example of the file attribute table in an example.
[Drawing 6] It is the conceptual diagram showing another example of the file attribute table in an example.
[Drawing 7] It is the block diagram showing the program composition of other file servers of an example.
[Drawing 8] It is the flow chart which shows the flow of the file access operation in an example.
[Drawing 9] It is the flow chart which shows the flow of processing of the file management which can be set for it to be able to set in the example.
[Drawing 10] It is the conceptual diagram showing an example of the file storing gestalt in an example.
[Drawing 11] It is the conceptual diagram showing another example of the file storing gestalt in an example.
[Drawing 12] It is the block diagram showing another example of this invention.
[Drawing 13] It is the block diagram showing still more nearly another example of this invention.
[Drawing 14] It is the block diagram showing still more nearly another example of this invention.
[Drawing 15] It is the block diagram showing still more nearly another example of this invention.
[Drawing 16] It is the block diagram showing still more nearly another example of this invention.
[Drawing 17] It is the block diagram showing still more nearly another example of this invention.
[Description of Notations]
10, 20, 30 -- A client computer, 11 -- Application program, 50 [-- Master file server,] -- A network, 90 -- A file server system, 100 110, 120, 130 -- A file server, 200, 210, 220, 230 -- Communications control means, 300 -- A remote file AKUSEKU processing means, 500 -- File management means, 508 [-- A file access control means, 700, 710, 720, 730 / -- A file storing means, 900 / -- LCMP network,] -- A file attribute table, 509 -- A load information table, 600, 610, 620, 630

[Translation done.]